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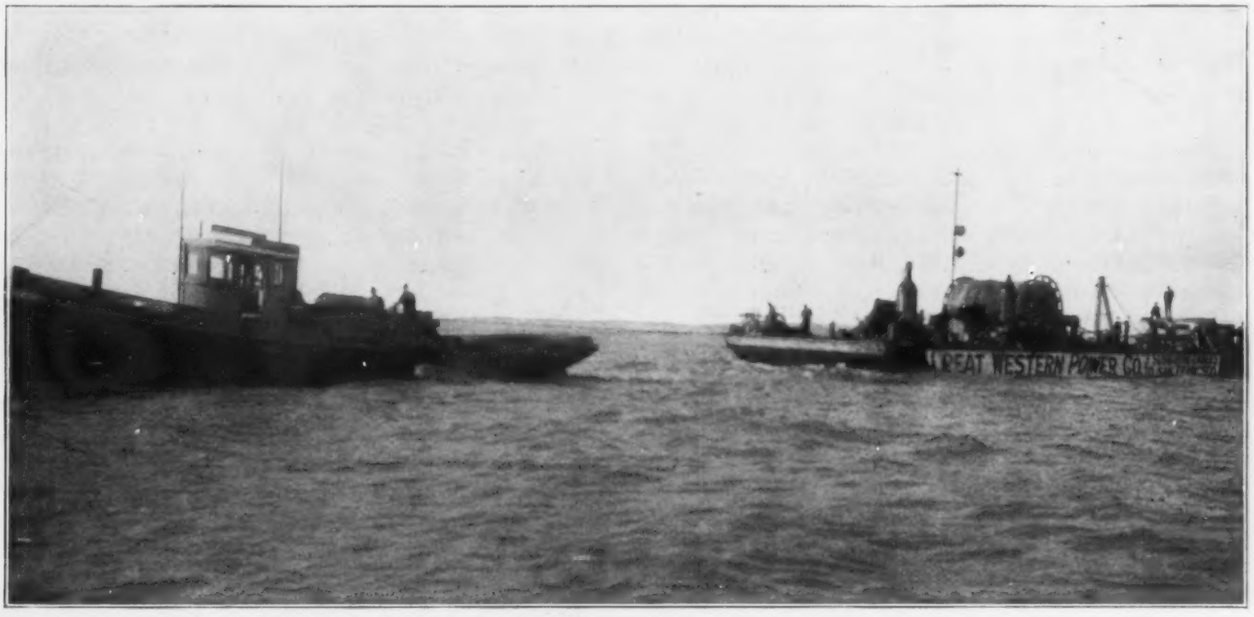
LAYING POWER CABLES ACROSS SAN FRANCISCO BAY

BY J. A. KOONTZ AND L. P. CORNELL

(This paper describes the latest feat of the Great Western Power Company in laying a cable across San Francisco Bay. It was presented at the May 26th meeting of the San Francisco section of the American Institute of Electrical Engineers. The authors are engineers with the Great Western Power Company.—The Editor.)

Submarine power cables were first proposed for transmitting power under San Francisco Bay some twelve years ago by S.L. Naphthaly, then with the San Francisco Gas & Electric Company. At this early date the cable manufacturers would not attempt building a submarine cable larger than three No. 2 B. & S. gage wires insulated for 15,000 volts. Three years later they were only in a position to build a 4/0 15,000 tape armored cable.

In 1912 the Great Western Power Company installed its first 22,000 volt cable across the Carquinez Straits. This was a tape armored, varnished cloth insulated cable, and hence it was necessary to use some means for taking care of the mechanical strain. So a messenger cable was used, to which the tape armored cable was served, leaving sufficient slack in the power

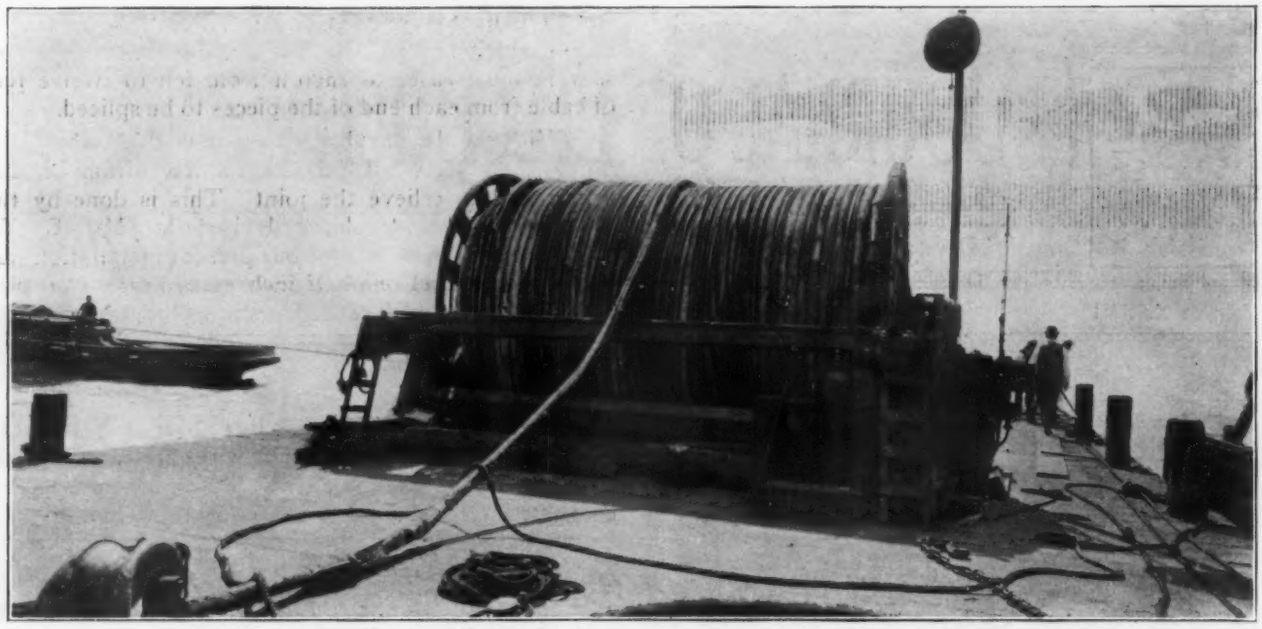


Cable Laying Barge.

The engineers and directors of the various power companies were skeptical concerning the reliability of such cables and would not sanction the installation of one until late in 1911, when the management of the Great Western Power Company decided to install a 15,000 volt cable across San Francisco Bay to connect the 11,000 volt distributing system of the Great Western Power Company in Oakland with that of the City Electric Company in San Francisco. This cable was first placed in operation in January, 1912, and is still in operation. The first submarine cable was a 4/0 three conductor, 15,000 volt cable.

A person not familiar with submarine cable installation cannot fully realize the strains to which a cable is subjected during the process of laying. Triplex cables of 250,000 to 300,000 c.m. sizes have a weight

cable so that all mechanical stress would be thrown on the messenger. This method of using a messenger cable was later patented by Mr. A. J. Pahl and the method in detail of laying cables in this manner was very ably presented in a paper before the Institute by Mr. Lisburger of the Pacific Gas & Electric Company.



Reel With 8500 Ft. of Cable, Weight 106 Tons, Reaching from Goat Island to San Francisco.

of about twenty to twenty-five pounds per foot, and when these are being laid in water from fifty to one hundred feet in depth and the barge is subjected to swells from ferryboats or other vessels there is a sudden impact which in the past caused a great deal of trouble.

The conductors of the first cable were insulated with 5/32 in. of 30 per cent para rubber compound taped with 2/32 in. varnished cloth thereover, bunched around with jute and then given a belt insulation of 6/32 in. varnished cloth, making a total thickess of insulation between conductors and between conductors and sheath of not less than 13/32 in. Over this belt insulation was placed a 1/8 in. lead sheath, containing 2 per cent tin. A 4/32 in. jute bedding was placed between the No. 4 B. W. G. galvanized steel armor wires and the sheath, a 3/32 in. jute serving covered the armored wires, and the cable was given a final lime and sand finish.

Insulation on all three 15,000 volt cables connecting Oakland to San Francisco has been graded. The only change made in the last two cables was that of increasing the thickness of the rubber from 5/32 in. to 6/32 in. and the lead sheath from 1/8 in. to 5/32. in. In the last cable installed the stranded conductors were impregnated to prevent the creepage of moisture along same should the sheath become broken at any time.

This last cable was provided with a telephone pair which was placed in one of the jute fillers alongside of the conductors. It might be of interest to know that all the cable manufacturers at first seriously objected to placing a telephone pair in a 15,000 volt cable and it took almost six months to convince the manufacturing companies that it was feasible to use such a pair of wires for communication work and to do so without injury to the cable insulation.

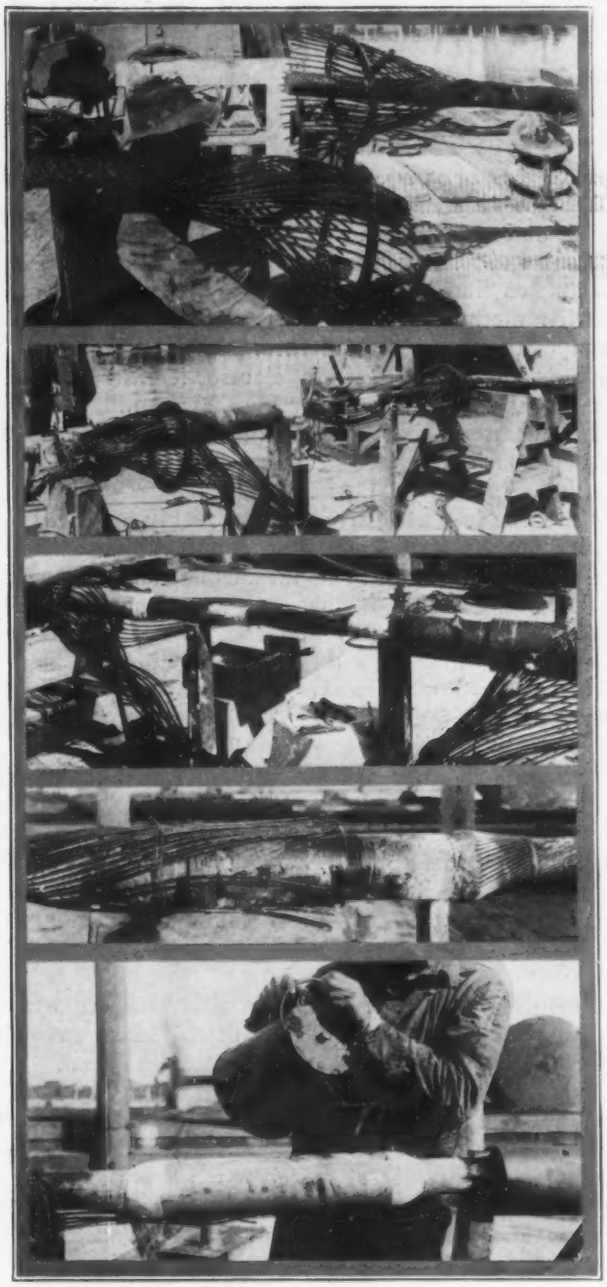
On the 22,000 volt cables across the Carquinez Straits one is of graded insulation and the other varfinished cloth throughout. For high voltage cables the graded insulation undoubtedly gives a better voltage distribution throughout the insulation than the other types; but for cables of 22,000 volts or less I can find nothing from the operation standpoint that would show advantage of the graded insulation over that of a cable made of varnished cloth. I do not believe, however, that a cable that is to receive more or less rough handling should be insulated first with rubber, as there is less danger of the insulation being broken from frequent bends or other abuse. To date we have never had a failure in the insulation of a submarine cable except at a splice or where the cable had been injured from some external source.

The cable companies have been improving their methods of manufacture of submarine cables, and today we get a cable that will stand more rough handling than those we received a few years ago. They are able to place the insulating material around the conductor much more firmly and to pack the jute tighter, so that after the cable has gone through the leading presses it is quite incompressible and will stand considerable pressure without distortion.

This point is of great importance in that we can now place considerable stress on the spirally wrapped armor wires without having them imbed themselves in the cable proper and thus increase their length.

While it is true there has been some trouble at the joints of the first power cables, this trouble has been mechanical and not of an electrical nature, the difficulty being to get a mechanical connection between the armor wires such that the strain will all be taken up by the former and none transmitted to the lead or conductors.

We have had actual cases in the old type of joints where the lead sheath would be pulled apart and other cases where the lead would flow sufficiently to throw the strain on the conductors and in one instance one of the conductors pulled out of the copper connecting sleeve without injuring the insulation between the conductors or to ground, leaving this conductor open circuited and insulated.



Cable Splicing Methods—First, Laying Back Armor; Second, Conductors Bared for Splicing; Third, Conductors Ready for Belt Insulation; Fourth, Armor Welded to One End of Turnbuckle; Fifth, Lead Joint Finished.

In the first cable great stress was placed on getting a good lead covering over the joints, in fact, a double sleeve was used so that if one should become injured the joint would still be waterproof. The armor wires at splices were first single lapped, that is, the armor wires on one end of the cable were served back over the armor wires on the other end of the cable. In latter joints we tried a double lap in which the armor wires were woven back over the cable on both sides of the splice, each layer of armor being served in place, and in some cases locking rings were placed in between the layers of the armor wires in an attempt to get a tight mechanical joint between the armor wires of the spliced pieces. With this latter method we have had very good success, but it is a tedious joint to make and is wasteful of cable, it being necessary in most cases to cut off from ten to twelve feet of cable from each end of the pieces to be spliced.

With the dense cable we are now able to buy it is possible to place all this mechanical strain on the armor and to relieve the joint. This is done by the use of a turnbuckle sleeve devised by Mr. E. W. Beardsley. This sleeve for our present installation was made of four and one-half inch extra heavy iron pipe which was cut and threaded with right and left threads and a suitable coupling used to fasten the two pieces together. The joint is made up in the usual way till after the lead sleeve is wiped. Then this sleeve is slipped over the joint, which has been carefully wrapped with asbestos. Then the armor wires are carefully laid in place and oxy-acetylene welded to the ends of the sleeve. After the armor wire has been welded to each end of the turnbuckle, the coupling is then tightened up so that the armor wire is in tension.

Elaborate tests were made before these splices were adopted. A tension of 28 tons was applied to both the armor and conductors on each side of the sleeve, first lengthwise and then by confining the turnbuckle parallel to the floor and hoisting both ends of the cable on the hook of a crane at right angles to it. This test was stopped at 28 tons because that happened to be the limit of the ring bolt in the concrete floor. A potential test of 53,400 volts was applied for five minutes between conductors without failure, and was stopped at this point because of the brush discharge between the ends of the conductors. A tension of 100 tons was later applied to the armor wires on each end of a section of the cable without causing measurable elongation or any change in its appearance.

The cable laying barge was 86 ft. x 35 ft., equipped with a reel of ordinary type 6 ft. drum, 16 ft. long, gear driven by a steam engine. The capacity of the barge was 200 tons, of the reel 125 tons. The cable was furnished by the General Electric Company in lengths of 1000 and 1308 ft. Several of these lengths were joined together to form a section suitable for laying while the barge was tied at the dock, and this work proceeded at the rate of a splice a day.

To accomplish this result the men worked in rotation. The cable splicer and his helper started the day and were followed by the welder, and he in turn by five stevedores and the donkey engineer, who placed the cable on the reel and made ready for the next splice.

When a section of desired length was formed the barge went out and laid it and returned to the dock, where the operation was repeated.

At the start, 11¼ hours elapsed in making a splice, of which 4 hours were used in welding the armor. Toward the last the workmen became more expert and finished splices required only 6½ hours, of which 50 minutes elapsed in welding each end of the armor. Fourteen splices were made under these conditions.

The cable is divided naturally into three parts. Parts one and two are separated by a switching station located near the east end of Goat Island; parts two and three by 1200 ft. of underground across the west end of the island. Each of these parts was laid in two sections. The laying of each section began at the

shore end, and the two sections were designed to meet in the bay, the meeting point being chosen for moderate depth and avoidance of wind, tide and the usual steamer routes. The laying of each part in this manner necessitated the making of one splice in the bay, or three in all. The actual time of laying the six sections was 3 hours and 57 minutes.

During the operation of laying, the barge was towed by a 110 h.p. gasoline launch, and held on its course by a 1¼ in. steel rope attached to either shore. When the end of the power cable was put overboard in the bay it was attached to the guide rope to facilitate its recovery. After the laying of the power cable was finished the guide rope was reeled up and taken ashore. While laying, the barge was easily controlled or anchored by braking on the guide rope and the cable reel.

The first two parts were laid on an ebb tide. As the third part had an angle in its course, advantage was taken of both ebb and flood. Laying was once postponed for one day because of foul weather. As the barge could await a calm before leaving the dock and the laying occupied only a few hours, the marine risk was believed to be so slight that no insurance was carried on either barge or cable. This was to us the most gratifying feature of the whole undertaking.

The Great Western Power Company has laid and is now operating 26 submarine cables of a total length of 77,250 ft. Two are 4000 volt, three 11,000 volt and twenty-one 22,000 volt. One of the 4000 volt cables, 900 ft. long, crossing Steamboat Slough, from Grand to Sutter Island, is ordinary No. 2 triplex, lead covered, paper insulated, underground cable.

The other principal talking point is that the total cable wasted was 67 ft. cut off in splicing. For comparison, 446 ft. was wasted on No. 2 Bay Cable, the value of which was over $1200.

The longest section of cable on the reel at one time was 8500 ft., reaching from Goat Island to San Francisco, which cable weighed approximately 105 tons.

The electrical part of each splice was the same as for ordinary underground work, except that the specifications called for superior materials and special care.

Gum-faced para compound and adhesive linen tape were used, both products being developed and furnished by the General Electric Company. Each taped conductor was calibrated to assure the proper thickness of insulation at all points. The conductors, after being taped, were wound with wrapping paper to exclude dirt or moisture, until all were ready for the belt insulation. The temperature of the ozite was taken before pouring and after it entered the sleeve. The lead sleeves were 4 in. x 20 in. and ¼ in.thick; 4/16 in. asbestos board was placed between the lead sleeve and the turnbuckle; ¾ in. holes were drilled in the turnbuckle to admit water, and the ends of the turnbuckle dammed with powdered asbestos. The turnbuckle was kept full of water during the welding process.

The elapsed time from the beginning to the end of the work was 35 days, which included time spent in rigging the barge, pulling in the shore ends and waiting for fair weather.

To protect the cable from ships' anchors it is proposed to erect an illuminated sign, legible from any point in the channel and backed by range lights accurately defining the location of the cable.

FEASIBILITY OF ELECTROCHEMISTRY AT THE DALLES.

BY O. F. STAFFORD.

(Continued.)

Cyanides.

The class of chemical compounds collectively called the cyanides fills a comparatively small although very important place in the fields of chemistry and metallurgy. The processes used in their manufacture have been various, changing from time to time as "improvements in the art" have come about. Earlier methods were based exclusively upon the decomposition at high temperatures of organic materials rich in nitrogen. Certain electrochemical products, however, such as metallic sodium, cyanamid, etc., may be used intermediately in cyanide production and for this reason cheap electric power has been considered as the ultimate need in the industry.

In the last analysis it will probably appear, however, that the cheapest source of cyanides will be from residues obtained in the alcohol and beet sugar industries, and that furthermore these sources will be able to supply the whole demand. Whether this prediction ever may be fulfilled or not it is certain that no large amount of power can ever in any case be diverted into the making of cyanides for the reason that the whole world consumption is but 25,000 tons per year, the manufacture of which would require power in quantity not exceeding in any event 25,000 horsepower-years. So far as can be seen at present this world-consumption of cyanide is not likely to have any large increase in magnitude, nor would any possible reduction of price stimulate consumption greatly.

Graphite.

An electrochemical industry of minor importance is the making of artificial graphite, the sole raw material for which is said to be anthracite coal. The product is graphite of high grade which may be formed in the course of manufacture into almost any desired shape or size. The properties of this graphite make it a most useful material for a wide range of purposes, extending from its application as a lubricant in the form of the finest suspensions in water or oil to the use of massive electrodes in exacting electrochemical processes.

The production of electric furnace graphite in 1912 is given as 6500 tons. Since both the favored raw material and the market are in the East the economical manufacture of graphite at a western locality may be said to be an impossibility.

Fixation of Atmospheric Nitrogen.

Four-fifths of the atmosphere by bulk consists of the chemical element nitrogen. It exists in the air in the "free" state as opposed to the forms of chemically combined nitrogen familiar to every one as ammonia, ammonium compounds, nitric acid, sodium or potassium nitrates, etc.

It is only these latter forms of nitrogen, where the element is "fixed" or chemically combined with other elements, which are of use in the arts and industries. The enormous store of free nitrogen in the air, amounting to seventy million pounds over every acre of the surface of the earth, is consequently useless for the growing of crops, the making of dyes, ex-

plosives, medicines and many other useful things until transformed by chemical processes.

Nature apparently has provided no very rapid method for this transformation, and hitherto in the history of the world practically all stores of combined nitrogen seem to have been produced slowly by the activities of certain soil bacteria. Where the soil is cultivated without due regard to the growing at suitable intervals of crops which harbor these nitrifying bacteria the yields begin to fail and in the course of time are unprofitable.

For the purpose of replenishing the stores of nitrogen compounds in the soil where intensive agriculture is followed and at the same time supplying the nitrogen compounds used in the arts and industries a number of sources have served in the past the most important of which are the following:

(a) The nitrate deposits of Chile from which there has been obtained as much as two and one-half million tons of sodium nitrate per year. Eighty-five per cent of this amount is ordinarily used in agriculture and fifteen per cent in the industries.

(b) The ammonia obtained as a by-product in the making of coal gas and coke. Reduced to its equivalent of ammonium sulphate this substance was produced in the United States in 1913 to the extent of 200,000 short tons. The world production for the same year was nearly 1,500,000 long tons.

(c) Certain by-products from the packing house industries, cotton-seed meal, fish scrap, guano, etc.

As to the sufficiency of these sources of nitrogen compounds, it may be said that the nitrate deposits of Chile appear to be approaching exhaustion, so that within a few decades at most the recovery of nitrate will become so expensive as to be prohibitive. The recovery of ammonia from coal is an industry that will develop rapidly for years to come and this source may therefore be depended upon with confidence for increasingly larger returns. The supplies of nitrogenous fertilizer originating in the packing house, cotton seed, and fishing industries properly should to a much greater extent be diverted to use as food materials for stock, poultry, etc., so that these sources in all probability will fail practically in the course of a short time. Guano may be said to be already a thing of the past. It follows, therefore, that of the major sources of commercial nitrogen compounds only one, the production of by-product ammonia from the coke industry, can be depended upon to increase with time. It is admittedly the case that the growth in productivity of this single source will by no means keep pace with the increasing demands for nitrogen compounds for all purposes. Economists of a dozen years ago were genuinely alarmed over the outlook for a supply sufficient for the needs of agriculture alone and the prediction was made in all seriousness that the world was facing actual hunger.

Direct Oxidation of Nitrogen.—The fact that nitrogen could be chemically combined with oxygen at high temperatures has long been known. Not until 1903, however, did experiments looking toward the technical utilization of the fact hold out promise of success. Dating from the year mentioned an industry has arisen whereby the electric furnace is made to yield the necessary high temperature for the chemical process in question. The industry at the present time is of significant magnitude, involving investments of many million dollars, and absorbing hundreds of thousands of horsepower of electrical energy. It has its main seat in Norway—partly for the reason that Norwegian engineers first solved the problem of "fixing" atmospheric nitrogen upon a commercial scale, and partly because of the unequaled water power facilities existent in that country.

At the present time there are three somewhat different processes in use based upon this direct oxidation of nitrogen. They are known respectively as the Birkeland-Eyde, the Schoenherr and the Pauling processes. All produce nitric acid which in turn can be converted into any desired nitrate. Each of these processes is lavish in its use of power, the power requirement for a short ton of nitric acid being upon an average among them about 2.7 horsepower-years. This high power consumption, however, is compensated to a degree by low costs in other respects so that with power costing not more than $10 per horsepower-year these methods of producing nitrogen compounds are commercially profitable. Up to the present time the industry in Norway has had the advantage of water power costs said to be not more than $6 per horsepower-year. At $9 per horsepower-year it is estimated that these direct oxidation methods should yield nitric acid at not to exceed $35 per ton. The corresponding equivalent costs of sodium nitrate and calcium nitrate, respectively, for conditions at The Dalles would be $32 per ton for the sodium nitrate and $24 per ton for the calcium nitrate, allowing $10 per ton for the sodium carbonate necessary for the conversion into sodium nitrate and $2 per ton for the limestone that would be used in making calcium nitrate.

The normal average price of sodium nitrate from Chile delivered at west coast ports may be taken as about $30 per ton. The costs of making synthetic sodium nitrate are therefore practically the same as the market prices of the natural product. The tendency will be for the price of Chilean nitrate to advance continuously with time as the deposits become depleted so that eventually the cost of synthetic nitrate will determine all prices. Just at present, however, it should not be forgotten that the Chilean government levies an export duty of about $11 per ton upon all nitrates shipped from its borders. A reduction in this duty would enable Chilean producers to deliver at prices lower than the present estimated factory costs of the synthesized material.

Cyanamid and similar processes.—An entirely different method of utilizing atmospheric nitrogen depends upon the fact that at moderately high temperatures the element combines with a number of different substances to produce compounds which may with ease be converted into ammonia.

At the present time the most successful and most largely used process coming under this classification is the manufacture of cyanamid. This substance is made by heating calcium carbide moderately while in contact with pure nitrogen gas. The calcium carbide must be made in the electric furnace previously, and it is in this detail, of course, that the dependence of the process upon cheap electrical power consists. The resulting cyanamid may be used directly as a nitrogenous fertilizer constituent, or may be converted readily into ammonia, which in turn may be

changed into ammonium sulphate, ammonium nitrate, ammonium phosphate or any other desired ammonium compound.

The power consumption in the manufacture of cyanamid is considerably less per unit of nitrogen brought into combined form than in the direct oxidation methods first discussed. Compensating cost factors enter, however, which make final totals much the same in the two cases in the localities where the two processes are now in operation together.

The data at hand do not permit any exact estimate of costs attending the proposed manufacture of cyanamid at The Dalles. The same information, however, which permits the statement that the cost of synthesized nitrogen by the cyanamid process does not differ materially from the cost of nitrogen brought into combination by the oxidation process would lead to a figure near to $35 per short ton of cyanamid as commercially produced.

Whatever the actual cost of cyanamid may be, however, it is certain that a western plant as compared with an eastern one would be handicapped by heavier costs for all items in the manufacture excepting power and by the further fact that the low power consumption of this process would render this single advantage to be of but little significance. It is therefore certain that cyanamid manufacture in this territory must always be limited to the amount which can be marketed from a western point more advantageously than from an eastern one.

A number of substances other than calcium carbide have been tried out as media for the fixing of atmospheric nitrogen and in some instances these have been developed well into the commercial stage. Perhaps the best known among them is the Serpek process in which aluminum carbide is the active medium. Most of these process claim advantages in the way of lessened power consumption as compared with the methods discussed above. It must be pointed out, however, that reduced power costs alone, unless attended by significant reductions in the other costs of manufacture such as materials, labor, capitalization, etc., will mitigate, under the circumstances, against rather than for the establishment of such industries in the West.

The Haber process.—A third important method of securing artificial nitrogen compounds has been perfected by Dr. F. Haber, of Berlin. It consists in the direct combination of nitrogen with hydrogen, the result being the immediate formation of ammonia. The reaction proceeds in a manner suitable for commercial requirements when the gases are brought together under great pressure at about 500 deg. C.

The necessary raw materials are the two gases just mentioned together with power. Electric heating is desirable in this process, but quite possibly not an absolute necessity as in the other processes in use which operate at temperatures not attainable in furnaces heated by fuels. In any event the power consumption is stated to be small so that the process is relatively independent of cheap electric power.

Reliable cost data for this process are not available. The gases used must be of exceptional purity so that the opinion is held by some that only where hydrogen, particularly, can be obtained very pure as a by-product will it be possible for the method to compete with the older processes. With electrical energy available at a price of $9 per horsepower-year, however, it should be possible to make hydrogen as a primary product without consideration of any return from by-products of its own, such as caustic, oxygen, or whatever else, at a price well under 15 cents per pound, the power costs alone being but 4 cents per pound. Nitrogen, at the outside, should cost not more than 1 cent per pound. Based upon these prices the gases necessary for making one pound of ammonia would cost about 3½ cents. Assuming all other factory costs to amount to 2 cents per pound of ammonia produced the total cost of the product would amount to 5½ cents, a figure comparing not disadvantageously with the other established methods.

As a matter of fact it probably will develop that ammonia may be made by the Haber process at a cost somewhat lower than the above estimate. The required gases may be had at a lower figure almost certainly. Factory operating costs are entirely unknown, however, and can be judged only by the esteem in which the process seems to be held by its present owners, the Badische Anilin and Soda Fabrik. It is known that this powerful concern gave up its very large interests in the Norwegian oxidation processes upon the perfection of the Haber method and is said also to have forced German by-product ammonia producers to turn over to itself an even share of the German ammonia market.

Conclusions.—The above brief outline regarding the status of the principal methods of obtaining nitrogen compounds from the air shows conclusively that this whole question has reached a point where its industrial future must be considered assured. It remains, therefore, for the purposes of the present discussion, to determine as definitely as possible the course to be followed by this industry should it be established at The Dalles in order that it might operate most advantageously.

All available evidence, it would seem, indicates that the plan of necessity would be to manufacture ammonium nitrate by the use of one of the nitrogen oxidation processes combined with either the Haber or cyanamid process of making ammonia. The arguments, in brief, are as follows:

A minimum amount of heavy raw material would be needed.

There would be utilized the maximum amount of the cheapest raw material available at The Dalles, namely, power.

The product would contain more available nitrogen than any other compound that could be made, pound for pound, at anything like comparable cost and therefore to a greater extent than any other substance could stand transportation into the markets of the world.

More than any other substance might it command a premium in price because of its manifold uses. It can be used as fertilizer, as safety explosive, as a source of nitric acid, or as a source of ammonia.

As to its probable cost of manufacture it can be stated that based upon the costs of nitric acid and ammonia derived in the discussions which have preceded this should be in the neighborhood of $50 per ton. The demand for the product should be unlimited.

REPORT OF N. E. L. A. ELECTRIC RANGE COMMITTEE.

Electric cooking has been demonstrated to be successful and should be pushed by a large majority of central stations. This report deals with some of the problems involved in rapidly developing electric cooking.

Advertising.—National advertising campaigns in publications that reach the housewife should be vigorously pushed; these should be supplemented by special advertising on the part of the central stations.

Merchandising problems and co-operation with manufacturers.—Fairly satisfactory types of electric ranges are on the market; the central station, at the start, at least, will have to push the sale of ranges. It is absolutely necessary for the manufacturers and the central stations to co-operate on questions of design, construction and the merchandising of electric ranges.

Electric cooking and water heating rates.—Each central station will have to adopt the form of rate which adapts itself to its existing rates. Household cooking and baking in restaurants, bake shops, etc., can be profitably handled on a 3 cent rate; cooking in hotels, etc., requires a somewhat lower rate; water heating requires a rate of one cent per kw.-hr. or less.

Water heating.—Central stations must prepare to heat water electrically for a considerable portion of their electric cooking customers; present types of electric water heaters are efficient; storage of hot water is generally very inefficient; a beginning only has been made in the solution of the water heating problem.

Introduction.

Electricity has been sold for cooking purposes by central stations in this country for over sixteen years; however, but little development in electric cooking has occurred until the last five years; the remarkable growth of and interest in electric cooking during this period is but a beginning for, with many of the central stations who have been most active in developing this load, the gross earnings received from this source are less than one-half of one per cent of their total gross earnings.

But few of the housewives have any conception of the advantages of cooking with electricity; the large majority of central station men are skeptical as to its feasibility from the consumer's point of view, as well as that of the company.

Yet the very considerable load that has been obtained by central stations actively developing electric cooking, on the European Continent, in many tropical countries, in Canada and in many places in the United States; the fact that electric range business of many manufacturers has increased thirty fold during the past five years and the more than doubling, this year, of the number of concerns making electric ranges, causes all central station men to devote a great deal of thought to this question.

The electric range report presented at the Portland Convention of the Northwest Electric Light & Power Association last fall, was intended to furnish such information as could be hurriedly collected to enable the investigator of this question to determine:

1st. Is electric cooking practical from the housewife's point of view.

2nd. Is the cooking load a desirable load for the central station.

(a) From the point of view of the investment required.

(b) From the point of view of the operating cost.

(c) From the point of view of the earnings.

The committee appointed for the purpose of presenting this report assumes that the advisability of electric cooking, as far as the central station is concerned, has been settled by a constantly increasing number of central stations in the affirmative, and therefore devote our study and report to the problem involved in the development of the use of the electric range by our customers.

Advertising.

Your committee advances the following conditions as a basis of facts on which to discuss the advertising requirements of the electric range situation; and in setting forth the following premises, it is your committee's conviction that in the field of advertising lies one of the most promising opportunities for effective work on electric range cooking.

Contemplation of improvements in the advertising of electric range cooking seems to your committee to be predicated on the following present conditions:

1. That no established, fixed, or positive demand exists at present on the part of the public for electric ranges.
2. That the actual marketing of electric ranges (the placing of ranges in homes) is being accomplished as the sole result of strenuous and insistent sales efforts by central stations.
3. That so devoid of manufacturers' advertisements on electric ranges and electric range cooking have papers, magazines, and other advertising media been, that not one woman in a thousand can name, off-hand, a reputable make of electric range.
4. That to date electric range cooking is still shrouded in mystery of operation, uncertainty as to results and costs; despite the vigorous efforts made by central stations lately to draw aside the curtains and let in the light and truth on electric range cooking.
5. That the great majority of new homes and apartment houses are still being built without wiring installed for electric ranges.
6. That not only is the burden of marketing electric ranges being borne by central stations, but that central stations are, in addition, bearing the burden of introducing, guaranteeing and familiarizing the public with the various makes of electric ranges,—an obligation that clearly should have been met in the past, and should be met in the future by the manufacturers of the ranges.
7. That it is now true that the experimental stage in the construction of electric ranges is largely past; that central stations have established rates permitting economical electric cooking, and there is a sufficient variety of types and styles of electric ranges on the market to meet requirements; that electric water heating devices are being developed

to a point where they promise to be efficient and economical.

With these things in mind, then as visualizing the present marketing conditions as your committee sees them, your committee respectfully submits the following recommendations:

A national advertising campaign in newspapers and weekly and monthly periodicals is urgently needed. This campaign should be carried on by the electric range manufacturers, either collectively or individually, and its purpose should be to drive home to housewives throughout the entire country the success of electric range cooking; its economy and its many advantages and possibilities and conveniences. Your committee feels that in all probability the electric range is today the only commodity or utensil in use, or which it is possible to use in modern kitchens, that has not been made the subject of strong, direct-to-consumer advertising campaigns, national in scope. Your committee believes that housewives have been taught to look for the manufacturer's message and guarantee on the appliances for use in the kitchen, and that therefore, electric range manufacturers are putting too heavy a burden on central stations in permitting the latter not only to introduce and foster electric range cooking to the housewife, but in advertising the electric ranges themselves and their various advantages and points.

Today the housewife who knows anything about an electric range knows it only by virtue of what she has learned from the central station salesmen, or central station advertising.

Let the manufacturers of electric ranges follow along these lines—either individually or collectively—and spend comparatively small sums each year in newspapers and magazines and other various media reaching housewives, and your committee is convinced that such a move would instantly take its place as a fundamental element in the greatly increased use of electric ranges.

It occurs to your committee that inasmuch as the Society for Electrical Development is supported to a large extent by electric range manufacturers, that an advertising appropriation could be set aside by the society to be devoted to a national campaign furthering electric range cooking along educational lines.

The advertising campaigns of the individual manufacturers should tie up to the society's campaign in the nature of copy, etc.

Your committee believes that the advertising done by either the society or the electric range manufacturers, or both, should give emphasis to the following points:

1. That the elementary experimental stage of electric range cooking has long since passed.
2. That the age of electric cooking has not only arrived, but that it now occupies an impregnable stronghold in the homes of thousands of women.
3. That there are fixed standards in the manufacturing of electric ranges, to which all reputable manufacturers adhere—and this forms the housewife's protection in (1) adopting electric range cooking and (2) in selecting the make of range that most appeals to her.
4. Then drive home the general advantages of electric range cooking—cleanliness, economy, safety, added personal comfort, and all the other points that make for superiority in electric cooking over all other forms.

And on this foundation of manufacturers' publicity and advertising, may then be reared a superstructure of proper and adequate and effective co-operation in the supplementary advertising that will have to be done by both manufacturers and the central stations.

Then, too, will the central station be able to take its proper place in the scheme of marketing electric ranges and exercise its natural function of helping the house-wife to select the size and type of electric range best suited to her individual needs; of helping and aiding her in the operation of the electric range; and in keeping the range on its lines year after year, while each such range by its own success and word of mouth advertising, will sell other ranges.

Your committee believes that special literature should be available for the use of central stations in their efforts to interest domestic science and home economics departments of public schools, colleges, and similar institutions in electric cooking.

Your committee suggests further that special literature be prepared for architects and builders so that they may have data upon which to recommend electric cooking to their clients and provide for range and water heating wiring in all new and remodeled residences and apartment buildings.

Your committee believes it would be a good thing to have an electric cook-book prepared for distribution by central stations; this book to contain information on the principles of electric cooking, on economical methods of using the electric range, and on methods of preparing and cooking articles of food on the electric range.

Your committee believes that the following will be of additional benefit in the advertising campaign:

The use of a national slogan, such as "Cook by Wire," in all advertisements and literature dealing with electric cooking.

Billboard posters featuring "Cook by Wire" slogan, lithographs of electric range in use, with educational reading matter.

Readers and articles on electric cooking to be circularized among newspapers and periodicals.

Pamphlets on electric cooking, embodying the ideas used in newspaper and periodical advertising. Such pamphlets should contain educational reading matter, attractive cuts, and useful information about electric cooking, and should be distributed by central stations among their consumers.

Form letters and postals with human interest for "Direct to Consumer" advertising by central stations.

Cuts, literature and display copy for use in local newspaper advertising. In case the central station handles more than one make of range, it is desirable that this material should be neutral in character insofar as competitive range features are concerned.

Manufacturers' pamphlets or catalogues to be distributed by central stations, containing educational reading matter, illustrations, descriptions and prices.

Manufacturers' booklets containing effective testimonials and illustrations.

Electric range cooking demonstrations in connection with local newspaper advertising.

(To be continued.)

MUNICIPAL OWNERSHIP OF RAILWAYS AT SAN FRANCISCO.

BY JOHN KENDRICK BANGS.[1]

A recent issue of a magazine devoted to the literature of exposure contains an entertaining article by a prominent socialist on "The Common Good vs. Private Greed," in which its accomplished author paints a most alluring picture of the success of the municipal railways of San Francisco and the sad failure of the United Railways of that same favored city. It is indeed a glowing account of conditions alleged to exist in California, where everything fructifies in such lush profusion that it is scarcely any wonder that in the year of grace 1915—Exposition year, by the way, with millions of extra consumers of its product—even a municipally owned railway should show fruit large enough almost to be accounted a "melon."

The author of the article in question is a man of great enthusiasm and sincerely devoted to the causes he represents, and it is therefore not so very surprising that, in the exuberance of that joyous moment when he has at last discovered one municipally owned tramway in America, which, in one year, under extraordinary conditions, has actually proven a paying proposition, he should dwell almost wholly upon the alluring side of the picture.

That he should perceive only the roses of municipal ownership and the thorns of private greed is possibly quite to be expected considering the visual peculiarities of the municipally owned eye; and just as some foreign critics of American manners contrast unfavorably to ourselves the deportment of American hucksters and yokels with that of the British aristocracy, the French noblesse, or the mediatized families of the Teutonic powers, so does this ardent commentator contrast the worst aspects of private ownership with the supreme virtues of the municipal enterprise.

He speaks feelingly, for instance, of the greater courtesy of the municipal employes. But it has been our good fortune recently to visit San Francisco, and it has pleased us to test his inferences by personal experience, and we are glad to be able to report that in respect to the Chesterfieldian qualities of the public servants of the rival lines there is no perceptible difference. He speaks of the filthy cars of private ownership, and intimates a glorious cleaning-day freshness about the rolling-stock of the city. But, again, we have travelled on both and we venture the statement with a positiveness born of personal observation that only a nose devoted professionally to the discovery of smells could possibly sense any inferiority on either side.

The author states, in respect to "road-bed and track," that that of the private companies is "largely punk," while that of the municipal lines is "the best obtainable construction throughout," of which statement we can only smilingly say that in point of accuracy it is remarkably like the popular Boston jest, which our esteemed friends of the Boston Transcript print about once a week, that New York is a horse-car city because somewhere down-town in the metropolis, for the preservation of certain charter rights, there is a joyous relic of other days being hauled daily to and fro across town by one, or maybe two, ancient nags.

As to equipment, this historian has also to say that the United Railways have "some large, dirty cars some Noah's Arks," while the M. O. cars are "the best, newest, and most efficient," another delightful specimen of the reserve of statement by these bifocal observers of modern conditions who gaze upward through rose-colored glasses and glance downward through lenses of murky yellow.

But in connection with this point, even if one were inclined to grant the truth of the criticism, it is a fact, of which the author does not seem to be aware, and one which we fear the citizens of San Francisco themselves are not yet aware of, that when the municipally owned venture started in, its sponsors actually borrowed from the privately owned companies the plans and specifications upon the lines of which the present municipally owned palace-cars were built, and used them without pay, for their own good purposes!

Another point advanced by this engaging writer has to do with the relative cost of the administration of the business of these two competing lines. He shows us that the private company employs an imposing staff of salaried officials to conduct its business, while the municipal company has but one executive employe, a superintendent, who is paid $5000 a year.

Of course the "Board of Public Works of San Francisco," which takes general care of the municipal railway, devotes its unremitting attention and service to the great work gratis; and the city attorney and his assistants, who look after its legal business, derive all their pay from pretty little personally owned vineyards and orchards in the fructiferous outskirts of this garden city of the world; and the employes of the other city departments, who in one way or another have to sit up nights to boost the city's pet enterprise to loftier levels, is made up of self-sacrificing altruists who would scorn, as corrupting, the offer of any pay for their services beyond the kind words of a grateful public.

Consequently, barring that $5000 superintendent, there are absolutely no overhead charges to drain the pockets of the tax-payers, which makes it all the more remarkable, in our view, that the cost of a ride on the municipally owned lines is precisely the same as that upon the corrupted lines of rust operated by old Brother Greed!

This all constitutes a beautiful picture of self-sacrifice, the contemplation of which fills us with admiring wonder. Of course we are not let into the secret of how it has all been brought about.

We are not told how, when the duly appointed protectors of certain definitely assured rights have turned on their persecutors and have said, "Your acts are unlawful," and have proven the illegality of those acts in the courts, these upholders and makers of law have deliberately flouted the courts, consigned them to a balmier climate than that of the San Joaquin Valley and treated their decrees with contempt. And then, when brought to book, have secured from the state legislature full authority to continue to defy the law and repudiate their expressed written obligations.

Meanwhile the highest fiscal official of the state of California, Controller John S. Chambers, within

[1] In "Concerning Municipal Ownership."

the past few weeks, has officially announced that the increase of taxation in the state has been at the rate of 33 1/3 per cent faster than the increase of taxable property, and he has issued to the public the following impressive warning:

The totals of our receipts and expenditures are huge and the percentages of increase alarming. As our population grows and our governmental problems multiply, the legitimate cost of government will go up. But we should put the brakes on. Even legitimate expenditures can be held down or postponed. How long can we stand the present state of affairs? Should the present rate of increase continue, the burden will soon become unbearable. We vote away millions of dollars with scarcely a thought to the future. The bonds will run anywhere from fifteen to forty years longer, with the bulk of the principal and interest to be paid by our children and our children's children. But I protest not only in the name of posterity, but in the name of the taxpayers of the present day. The burden is already too heavy. It is time to stop and think.

In support of this warning the controller notes that in the past five years the bonded debt of the state has increased 457 per cent, that of the counties 308 per cent, and that of the cities 98.6 per cent, "with large amounts of bonds authorized but not yet sold." He implies that, computed at 4 per cent, which is below the rate paid by political subdivisions of the state, the interest on the total debt of the state and its subdivisions for 1915 was $10,113,500, or approximately the total cost of running the state government five years ago, before, to quote a resident of San Francisco, California, "started on its present orgy of debt and taxation."

LECTURE COURSE IN ILLUMINATING ENGINEERING.

The Illuminating Engineering Society has arranged for a series of lectures to be given at the University of Pennsylvania this fall. These will differ in scope from those given at John Hopkins University in 1910 in that it will deal more with the application of principles than developed.

The present series of lectures ought to be of direct and great importance in inculcating the appropriate and wise use of illuminating appliances, and should be therefore especially valuable to those who are dealing directly with the problem. The theoretical side of illuminating engineering will not be neglected, but to increase its practical usefulness to the public is a fundamental purpose of the course.

Preliminary List of Subjects for I. E. S.-U. of P. Lectures.

Subject.	Number of Lectures.
(A) General.	
(1) The Principles of Interior Illumination	2
(2) The Principles of Exterior Illumination	1
(3) Color in Lighting	1
(4) Architectural and Decorative Aspects of Lighting	1
(5) Recent Developments in Electric Lighting Appliances	1
(6) Recent Developments in Gas Lighting Appliances	1
(7) Modern Lighting Accessories	1
(B) Special Lectures on Interior Illumination.	
(8) The Lighting of Factories, Mills and Workshops	1
(9) The Lighting of Offices, Stores and Show Windows	1
(10) The Lighting of Schools, Auditoriums and Libraries	1
(11) The Lighting of Churches	1
(12) Theatre Lighting (including Stage Lighting) and the Lighting of Art Museums	1
(13) The Ligthing of the Home	1
(14) Train Lighting	1
(C) Special Lectures on Exterior Illumination.	
(15) Street Lighting	2
(16) The Lighting of Yards, Docks and other outside works	1
(17) Headlights, Searchlights and Projectors	1
(18) Sign Lighting	1
(19) Building Exterior, Exposition and Pageant Lighting	1

HAZARDS OF ELECTRIC HEATERS AND RANGES.

BY G. A. CLEARY.

(This timely information regarding precautions to be observed in the installation of electric ranges should be of interest to every electrical contractor and central station. The author is electrical inspector with the Board of Fire Underwriters at San Francisco.—The Editor.)

The utilization of electric current through the medium of resistance devices for cooking and heating is fast assuming proportions not thought of a short time back. This undoubtedly introduces hazards, both fire and physical, which should be intelligently dealt with. While the life hazard is of secondary concern, the hazard from fire is of vital concern to the underwriting interests.

As with every device that sooner or later will be widely used, obstacles must not be placed in the path of the ultimate user, so as to cause hesitancy. Reasonable restrictions as to the method of connecting electric ranges and water heaters are made to safeguard the risk from fire and the accidental contact of the person using the appliance with exposed live metal parts.

From the viewpoint of safety to life, an enclosed rotary switch is unquestionably superior to the knife blade switch. Housewives object to the use of knife blade switches in cabinets, on the grounds of unsightliness, one energetic manager going so far as to white enamel the cabinet to meet this objection. Of course where the range and water heater are connected so as to preclude their simultaneous operation, the knife blade type of switch must be resorted to.

All ranges should be permanently and effectively grounded. Lugs are now provided on most makes of ranges for this purpose. This is a detail involving little expense, as it only requires that a jumper be placed from the conduit feeding the range to the body of the range itself. The matter of grounding should concern the installer of every electric range, for if the untechnical individuals who inhabit most of our homes find that they are liable to shock, the news will travel quickly and incidentally cause the energetic salesman more worry in overcoming the prejudice of the probable user.

From an insurance viewpoint, an installation of electric ranges introduces little fire hazard where the regulations of the National Electric Code have been complied with. On the other hand, it has been felt that electric ranges properly installed are so preferable to coal or gas ranges, with attendant hazard of ashes, matches and open flame, that any unwarranted obstacles should not be put in the way of their development and use.

The Code treats the range as a complete unit, irrespective of the number of plates or ovens, and requires switches and cut-outs accordingly. Disregarding the switches mounted on the range and the fusing of the individual elements on certain makes, an indicating switch or plug connector and cut-out must be provided to disconnect and protect all wires of the circuit supplying the range.

Opinion differs as to the advisability of fusing of the individual elements; manufacturers such as the General Electric Company and Hughes Electric Com-

pany, make a practice of fusing separately; while the Hotpoint, Westinghouse, Simplex, etc., rely on the feed wires to the range for the required protection.

The question of fusing electric ranges is one most frequently asked, so that information on this point may be of interest. The matter of separate fuses for the units of electric ranges came up a number of years ago when some of the first appliances of this character were submitted to the Underwriters' Laboratories for examination and test. At that time there was considerable discussion on this question, and it was finally decided that it was not necessary to insist upon separate fusing in such construction. This opinion has later been confirmed in the examination and report of ranges of several manufacturers.

It was felt that the use of separate fuses for each unit would require quite a number of these fuses, which must be mounted in a wall cabinet separate from the range or mounted on the range itself. In the former case, the use of such subdivisions of circuits through fuses required a multiplicity of leads from the separate panelboard to the range, and a further complication of the range wiring itself. This is considered a disadvantage and unnecessary.

On the other hand, the location of the fuses on the range itself is undesirable because of the complication in the wiring resulting, and because of the possible improper relation of the fuses when subjected to the heat of the hot parts of the range itself. This question involves further complication in view of the fact that certain ovens are provided with plug fuses where the oven is designed to operate on a voltage that exceeds the voltage rating for Edison plug fuses.

Such ranges as are listed as standard are composed of non-combustible material and have substantial heater units fixed in position relative to each other and to the range as a whole. The wiring is of some flame-proof character, and the runs from the main distribution panel or switches on the range are short and well protected. A burnout, either in one of the units or in any of the connected wiring within the range, may reasonably well be depended upon to open the circuit, or that part of it which is in trouble, without producing conditions within the range which are themselves hazardous. It has furthermore been felt that from the practical point of view, it was probably desirable that the user should be called on to keep one and only one set of fuses, and these in the mains; rather than to maintain under somewhat difficult conditions existing in this character of service, a number of smaller fuses which require to be chosen with considerable skill in order to operate satisfactorily under working conditions.

Furthermore, very strong protests were received from manufacturers of ranges against requiring the sub-fusing, it having been felt, as above mentioned, that electric ranges afforded, from an Underwriter's viewpoint, a superior installation.

Water heaters utilizing the water as the conducting medium between the electrodes are not looked upon with favor, while in the case of the resistance unit type, the design anticipates the dissipation of the heat as generated, and they therefore present a fire hazard when used in receptacles where, in the event of failure of the water supply, while the heater is turned "on," the casing rapidly attains a high temperature, sufficient to ignite combustible material. But the probabilities of obtaining this condition in service are considered remote, and with normal operation these heater provide a relatively safe and ready means of heating water. In the former case, the resistance medium being in contact with the water, will permit a leakage of current to ground to an amount dependent upon the resistance of the water, between the resistance element and the metal casing of the water chamber. With water of ordinary purity, this leakage will be negligible. The hazard, both fire and life, in a device of this character is self evident.

Likewise, a device employing exposed luminous resistance element is hardly to be considered the equivalent of a unit that has the resistance wire adequately protected.

In conclusion, it might be mentioned that to recognize the fire and life hazard in electric ranges and water heaters, feed wires of the proper capacity should be selected; the use of approved switches to be located within sight of the range; fuses of the proper capacity to be installed in the circuit; ranges to be grounded; and lastly and most important the selection of an appliance that will stand up under a reasonable amount of hard usage and one that contains no apparent defect that might hinder its continued operation.

RAILWAY EQUIPMENT REQUIRED FOR MOVEMENT OF MILITARY UNITS AT WAR STRENGTH.

In view of the nation-wide interest in preparedness, there is printed below a table giving an idea of the amount of railway equipment that would be required in the event of mobilization and movement of various military units. The figures were obtained from the War Department by J. E. Baker of the Southern Pacific Company:

	Officers.	Men.	Animals.	Vehicles.	Guns, Complete.	Pullman.	Coaches.	Baggage.	Box.	Stock.	Flat or Gondola.	Total Cars.	Trackage (Feet).
	Personnel					Railroad Equipment Required							
Infantry Regiment.....	55	1890	177	22	..	5	43	5	15	9	8	85	5150
Cavalry Regiment	54	1284	1438	26	..	8	28	8	25	72	9	150	7850
Artillery Regiment, Light	45	1170	1157	32	24	9	23	9	25	58	46	170	8675
Artillery Regiment, Horse	45	1173	1571	35	24	10	24	10	25	78	47	194	9830
Artillery Regiment, Mountain	45	1150	1229	..	24	7	23	7	30	61	..	124	6405
Engineers, Pioneer, Battalion	16	502	165	12	..	2	12	2	10	8	4	38	2110
Signal Corps Field Battalion	9	171	206	15	..	2	4	2	5	10	5	28	1460
Infantry Division, comprising: 3 Brigades Infantry, 1 Regiment Cavalry, 1 Brigade Light Arty. 1 Pioneer Engr., 1 Field Battalion, Signal Corps, and necessary wagon trains.....	736	22285	7660	775	48	46	487	45	245	383	301	1507	82265
Cavalry Division, comprising: 3 Brigades Cavalry, 1 Regt. Horse Arty., 1 Pioneer Engnr., 1 Signal Corps Battallion, and necessary wagon trains	458	10259	12231	414	24	63	218	63	210	611	137	1302	77190

To move a Field Army would require: 2115 passenger cars; 385 baggage cars; 1055 box cars; 1899 stock cars; 775 flat cars; total 6220 cars, which make about 366 trains, and require this number of locomotives.

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NOTICE TO ADVERTISERS.

Change of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

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An Ancient Fable—

A Dog was lying upon a stall full of hay. An Ox, being hungry, came near and offered to eat of the hay. And the ill-natured Cur, getting up and snarling at him, would not suffer him to touch it. Upon which the Ox, in the bitterness of his heart, said, A curse light upon thee for a malicious wretch, who will nether eat hay thyself, nor suffer others to do it. Aesop.

and its Application

There are cities, perilously close to the limit of their bonded indebtedness and sadly lacking in schools, sewers, parks, police and fire protection, which propose to supply some favored citizens with street-car transportation, electricity and telephone service in competition with existing private utilities. The latter are giving good service, are paying taxes on heavy investments and are closely regulated as to rates. Yet because the politicians in the cities perceive an opportunity to build up a machine for patronage, they wilfully mislead their deluded followers into the folly of municipal ownership of public utilities.

That Seattle's municipal lighting plant cost taxpayers over one hundred thousand dollars last year because commercial service has been given at less than cost, and municipal lighting charged an exorbitant rate, was demonstrated in these columns three weeks ago. That Cleveland's municipal lighting plant is being conducted at a loss was pointed out in the same issue. San Francisco's subterfuges in accounting are detailed in this issue, and to this may be added the fact that the taxes in that city today are more than double those twelve years ago.

Notwithstanding these examples of what not to do, in spite of numerous disastrous experiences in the political operation of technical utilities, the citizens of Los Angeles, every bread-winner of whom is already paying an average tax of six dollars per month, now propose to further mortgage themselves in order to duplicate existing electric distribution lines. At this date there is pending before the California Railroad Commission an application on the part of the city to take over the business of one of the big distributing companies without due severance damage occasioned by cutting out the main outlet for power generated. Even if the company should be willing to sell its business in the City of Los Angeles, it should at least be for a fair compensation. In June, also the people of Los Angeles are to vote on the matter of issuing bonds to take over a telephone system.

As is well known, these several instances are merely typical of what is being done throughout the entire West, which is more or less of a laboratory for many socialistic experiments. Some few of these experiments may prove successful and be adopted into universal usage. But municipal ownership of public utilities as yet has been a dismal failure in most places largely because dependent upon political patronage for its perpetuation. Commission regulation of utilities is the mean between private and municipal ownership

and operation. It should at least be given a fair trial before going to the extreme of municipal ownership.

The evil to which attention is to be specifically directed is unregulated municipal competition with regulated private utilities. Private utilities are subjected to commission control, they cannot invade the territory satisfactorily served by existing companies and they pay heavy municipal and state taxes which contribute largely toward paying the expenses of government. Municipal utilities are exempt from all these requirements.

As a matter of fact, a modern city cannot expect adequately to care for all the legitimate matters requiring public funds and also enter into the business of supplying the inhabitants with telephone, street railway, gas and electric service. These latter utilities require large capital and involve some financial risk which a city should not be called upon to assume. Yet when they are operated to supply part of a community at the expense of the whole they create a condition with which private capital will refuse to cope.

So it is seen that municipalities are unable to give a complete technical utility service, they deter private enterprise by competition in favored districts and thus enact the part of the dog in the manger. Is it any wonder that the investor says "a curse upon thee" and departs to fields offering superior inducements?

A Word of Advice to the Electrical Dealer

Individuality is the target at which the electrical dealer should aim. It is the key that unlocks the door to success in modern retail selling. Every sales effort should be subordinated to and directed toward attainment of store individuality, as it is the secret of successful electrical merchandizing.

Store individuality is almost as hard to define as it is to acquire. It is more elusive than personality, for a store's individuality is largely a reflection of the owner's personality. It is like a person's good name.—priceless. It consists in being different, and while being different, being better. Doing things differently and doing things better are the duality that make for individuality.

Thus the individuality of a store is the aggregate of those things which make it a desirable place to do business, as compared with some other store. An electric shop is better than a department store as a place to buy electrical devices, because it specializes in their sale, gives trustworthy advice on their installation and offers a more judicious selection. It is different.

One of these "different" electric shops is better than another "different" electric shop because of any one or all of a number of reasons. Clerks are more polite, goods are more cheerfully and promptly exchanged, values are more as represented, or it is a more attractive place to buy because cleaner and lighter. It is this "moreness" in service that gives desirable individuality. It comes from not only "making good," but making better.

But what is the use of aiming at the target unless you hit the bull's-eye. The bull's-eye of individuality is the reputation for doing things differently and better,—renown for service. Profit from individuality comes only from public knowledge of it. Publicity must be given as to how the store is different and better if the store is to be characterized as a desirable place to do business, if an increasing volume of trade is to be developed, and if that trade is to be rendered permanent.

The expensive burden of creating the demand for electrical goods has been assumed by the manufacturer, so that it is merely necessary for the dealer to tie in locally with the national advertising. This can be done by proper display within the store, by dressing the windows well and changing them frequently, and by adequate window lighting at night. Some measure of publicity can be secured by enclosing advertising matter in packages as they are wrapped and by mailing literature to selected lists. And by all means the dealer should advertise things of news interest in the newspapers.

The electrical dealer has an advantage in newspaper advertising possessed by few other lines of trade. Electricity is interesting to the public and there is always something new to talk about. These elements are the essence of success in advertising and should be capitalized. Such advertising should be steady. It takes repetition to build reputation.

Manufacturers and jobbers are co-operating actively with dealers in the way of good advertising copy, store display and window dressing. These dealers' helps represent the best thought of some of the country's highest priced advertising men. A dealer is overlooking a good opportunity if he does not employ them to work for him. It is the manufacturer's part to create interest in the goods and the dealer's part to create interest in his store as the place to buy the goods. It is only through the dealer that the psychological reaction produced by advertising can be converted into real sales.

The most important factor in this problem of establishing a paying electrical retail business has been left to the end. After developing store individuality, after bringing people to the store and after making an attractive store, the final sale and the likelihood for future business is made or marred by the clerk. He should be well trained, well informed about the merchandise, courteous and filled with the ideal of service. The salesman, like the hands of a watch, is the customer's index as to the working of the organization.

Consequently sales people should be taught the selling argument that induced the manager to buy the goods, they should be impressed with the effect their tact has on the good will of the house, and they should understand the ways in which they can help the purchaser.

Summing up, the manager should put his enthusiasm, his knowledge, his ability, and himself into every branch of his business, thereby inspiring his assistants, his customers and the public with his own personality and thus gradually building up for his store a reputation for individuality.

PERSONALS

H. S. Title of the H. S. Title Company, will return to San Francisco from New Mexico next week.

Clarence Dunbar, purchasing agent Western States Gas & Electric Company of Stockton, was at San Francisco this week.

R. F. Eehan, Westinghouse Electric & Manufacturing Company, has returned to San Francisco from the San Joaquin Valley.

R. H. Coyne, Pacific Coast manager of the Kellog Switchboard & Supply Company, has returned to San Francisco from Los Angeles.

H. V. Carter, president Pacific States Electric Company, is attending the meeting of the electrical supply jobbers at Hot Springs, Va.

Howard Shield, formerly with the Electric Appliance Company, is now traveling out of Salt Lake City for the Capitol Electric Company of that city.

J. C. Clankinton, manager of the Hilo Electric Light Company, Limited, Hilo, Hawaii, was in San Francisco last week and left for the East on important business.

H. D. Pillsbury, vice-president, and **J. C. Nowell,** general manager of the Pacific Telephone & Telegraph Company at San Francisco, are making an extended trip East.

Ralph Elsman has resigned as engineer with the Pacific Gas & Electric Company, to act as underground engineer for the Electric Bond & Share Company at New York City.

H. G. Levy of the Electric Manufacturing Company, has returned to San Francisco from a trip to San Diego and back by auto. His running time on the return trip was eighteen hours.

C. C. Hillis, general manager of the Electric Appliance Company, San Francisco, was at Del Monte last week attending the convention of the Automobile Accessory Jobbers' Association.

Walter Smith, formerly with Holabird-Reynolds Electric Company, and recently with J. C. Hobrecht of Sacramento, is now in the San Francisco sales department of the Electric Appliance Company.

Samuel H. Taylor, president of the Electric Railway & Manufacturers' Supply Company, left May 27th for Hot Springs, Va., to attend the semi-annual meeting of the Westinghouse Agent-Jobbers' Association, which meets there on June 1-2-3.

S. B. Gregory, Pacific Coast manager of the Arrow Electric Company; **John Rendler,** president of the Southern California Electric Company, and **Allen Smith,** sales manager of Holabird-Reynolds Electric Company, have returned to Los Angeles from a four days' fishing trip at Big Bear Lake.

J. Ed. Erickson, formerly with Condit Electrical Manufacturing Company of Boston and later with Western Electrical Company at Cleveland, has joined the sales organization of The Packard Electric Company of Warren, Ohio, and will cover the territory formerly in charge of Mr. Benj. Smith, who retires.

W. J. Davis, Jr., Pacific Coast engineer General Electric Company; **W. G. B. Euler,** superintendent of operation Great Western Power Company, and **C. A. Turner,** plant engineer's office Pacific Telephone & Telegraph Company, have been elected as new members of the executive committee, San Francisco Section American Institute of Electrical Engineers.

L. H. Newbert, Leon Jones, Van E. Britton, F. S. Myrtle, and **M. L. Nealy,** manager of the Fresno office, all of the Pacific Gas & Electric Company, were present at the Pacific Coast Gas Association dinner at Los Angeles on May 20th. **Frank A. Cressey,** manager of the Modesto office of the Pacific Gas & Electric, acted as presiding officer at the dinner. There were 125 present.

MEETING NOTICES.

Technical Societies of Los Angeles.

A joint meeting of the technical societies of Los Angeles was held Thursday evening, June 1st. The subject of the evening was "Preparedness." A. H. Koebig presided and George A. Damon officiated as toastmaster. The following speakers talked on the various phases of "Preparedness": George W. Dickie of San Francisco, associate member of the Naval Consulting Board; W. H. Booth, vice-president Security National Bank; Earle Remington, president Aeronautical Society; Captain Richard Park of the U. S. Army; Captain Charles T. Leeds of the U. S. Army (retired).

San Francisco Electrical Development and Jovian League.

In the absence of President Cutting, Vice-President Hillis, and all but one member of the executive committee, who put in a belated appearance, the May 24th luncheon was ably handled by a volunteer group with T. E. Collins presiding. Incidentally, this was made the occasion for a little extemporaneous fun. Announcement was also made that a unique outdoor Jovian Rejuvenation would be held under the joint auspices of the San Francisco and Oakland Jovians at Trestle Glen, Oakland, June 10, 1916. Great preparations are being made to insure that this will be the most spectacular rejuvenation ever held locally, a number of special illumination features being contemplated. Mr. A. C. Rulofson, president of the Home Industry League, was then introduced and gave a graphic illustration of the benefits which would accrue from more united support of this movement. He also spoke briefly of the evils that would be entailed by the proposed prohibition measure.

California Association of Electrical Contractors and Dealers.

The regular monthly meeting was held Thursday evening, May 25th, at Oakland. L. B. Gilpin acted as chairman of the evening, introducing C. L. Chamblin, who spoke on the subject of "Credit," and made a plea for shorter credit terms, saying in part that extended terms of credit meant loss and increased overhead to the dealer and contractor. M. L. Scobey presented some remarks on the "Outlook from the Dealers' Standpoint," and urged the adoption of a more reasonable and sensible margin of profit for dealers. C. F. Butte, president of the San Francisco section, presented a most interesting and detailed report of the accomplishments and doings of the San Francisco section. H. C. Reid spoke of the accomplishments and benefits derived from association work and the lessons of co-operation taught. W. L. Goodwin of the Pacific States Electric Company, and A. Youngholm of the Electric Railway & Manufacturers' Supply Company, presented some practical illustrations on methods of profit figuring and cost estimating, which proved of great interest. Among other speakers of the evening were Robert King, Oakland, Frank Somers, San Jose, C. O. Gould and A. F. Flanagan, Stockton. The meeting proved to be one of the most enthusiastic in the association's history and a surprise which added to the hearty goodfellowship of meeting was the appearance of fourteen representatives of the electrical industry who had toured from Stockton by automobile for the purpose of demonstrating that they were alive to the electrical situation and even went further by announcing through their spokesman L. F. Youdall, they wanted the annual convention of the state association held at Stockton. To back up their claim they presented a most cordial invitation from the Chamber of Commerce of that city. The visitors were heartily cheered and the meeting by unanimous vote decided that the convention to be held this coming July should take place in the city of Stockton. The Stockton delegation was made up of the following members: B. Van Cott, L. F. Youdall, A. F. Flanagan, Wm. Murphy, C. O. Gould, H. S. White, R. Gould, D. G. Johns, C. D. Bass, C. Stanley, C. Frankie, F. Lyman, W. L. Hild, Geo. Tiffany.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The commission has authorized the Pomona Valley Telephone & Telegraph Union to use the proceeds from the sale of $60,000 six per cent bonds in retiring $28,475.12 of notes, $2000 of bonds, and balance for construction of office building costing approximately $25,000.

The commission has authorized the Martinez and Concord Interurban Railway Company to issue securities preliminary to constructing a line from Martinez to Concord, in Contra Costa county. The company is also authorized to issue $125,000 first mortgage bonds to be sold at 90 per cent of face value, and $125,000 cumulative participating bonds.

The Commission has authorized the Modesto Interurban Railway to issue $12,423.32 of promissory notes, payable to Union Savings Bank of Modesto and T. K. Beard, and to mortgage its property for $4000 to pay T. K. Beard for moneys advanced. Union Savings Bank of Modesto is to hold the mortgage.

The commission has authorized the Modesto Gas Company to issue and sell $65,000 bonds, at not less than 90, the Modesto Gas, Light, Coal & Coke Company to transfer all its property to the Modesto Gas Company for 995 shares of that company's stock, and the assumption by it of all the liabilities of the selling company. The bonds are 30-year, six per cent.

The commission has issued an order authorizing the Mt. Whitney Power & Electric Company to issue $450,000 face value of its first mortgage 6 per cent bonds under its deed of trust to the Bankers Trust Company of New York.

The commission has authorized the Martinez & Concord Interurban Railway Company to issue 600 shares of its stock, to be sold at not less than $80 per share; also 100 shares to Clifford McClellan and J. B. Rogers to reimburse them for expenditures in organizing company. The company is also permitted to issue $125,000 first mortgage bonds, to be sold at not less than 90, and $125,000 face value cumulative participating bonds to be sold at not less than par.

NEW CATALOGUES.

Sprague Electric Works have issued a number of new bulletins of interest. No. 333 is a folder attractively listing Sprague electric fans for direct current. No. 48706 is devoted to a.c. motors and controllers, 2 and 3-phase, for printing press drive, with special reference to flat-bed and small rotary presses, folders and other machines requiring motors of from ¼ to 15 h.p. No. 48907 tells of Sprague 500 lb. Electric Hoists, particularly as regards safe and economic operation. No. 49600 illustrates and describes flexible steel armored conductors, flexible steel conduit, stamped steel boxes, fittings and tools.

The Western Electric Company has issued a new catalog of Inter-phones and accessories. The various systems available for intercommunication are fully explained with diagrams showing the service given by each. New systems recently developed include a new annunciator system arranged for from ten to seventy stations or more, and a new apartment house system to provide for inexpensive and flexible installations. The new catalog gives all the information needed by the dealer, or contractor who would select, install and operate an Inter-phone system designed to meet practically any known requirement for intercommunicating telephone service.

A new and unusually complete catalogue of Telephone Apparatus and Supplies is being distributed by the Western Electric Company. Following a section devoted to miniature reproduction of sales and service helps, are listings of telephones, switchboards, power plants, cable, line construction tools, line construction materials and miscellaneous telephone apparatus. The telephone section is in reality a telephone text-book, in that it enables the buyer of central office and subscriber station apparatus to select exactly what he needs. This is made possible by unusually complete descriptions, circuit diagrams and directions for use. The Inter-phone section of the catalogue has been similarly assembled. Another feature is the uniform basic discount that applies to the list prices shown in the catalogue.

SAN FRANCISCO ELECTRICAL LEAGUE BASEBALL.

Due to the inconvenience of the wind and dust the league has decided to change their official grounds from the Ocean Shore to Balboa Park, at Ocean and San Jose avenues. This park, although a little further out, offers many advantages over the other grounds. Two diamonds will be used so that both games will be played at the same time, doing away with the disadvantage of a double-header. The grounds are grass covered and there are plenty of comfortable benches for the spectators. Both of the league games were played at Balboa Park last Saturday, May 27th.

Electric Appliance and Ermsco.

The Appliance boys took the first chance at swatting the ball, but the first two men up were struck out and the next man was put out at first. The Ermsco boys came up and connected with the ball for six hits, one of which was a home run and one a three-bagger. Three men were scored by Ermsco in this inning. The Appliance boys failed to score until the 8th inning, when they succeeded in making three runs, while the Ermsco boys had brought eleven men over the rubber to this part of the game. Appliance failed to bring in any more runs in the first of the ninth so the game was called at this point with the score 11 to 3 in favor of the Ermsco. Both pitchers worked well and received good support. Only two men were walked during the entire game, one man to each pitcher. Both pitchers struck out eight men.

General Electric and Western Electric.

This was another of those swat fest games, and appeared to be more of a race than a game. Western brings in 7 runs in the first inning, and G. E. succeeded in bringing in four. In the second inning Western got 5 more and G. E. doubled their score by bringing in 4 more runs. In the third inning Western scored 4 more runs, while G. E. was unable to score. The fourth and fifth innings neither side scored. In the sixth inning G. E. scored 2 more and Western was able to run 7 men around the bags. G. E. tried hard to tie the score in the first of the seventh inning, but were only able to land 2 runs. The game was called with a score of 23 to 12 in favor of Western Electric.

Standing of the Teams.

	Won.	Lost.	Pct.
Pacific States Electric Co.	5	0	1000
Western Electric Co.	4	1	800
Ermsco	2	4	333
Electric Appliance Co.	1	4	200
General Electric Co.	1	4	200

TRADE NOTES.

The Westinghouse Lamp Company announces the removal of its executive offices to the City Investing Building, 165 Broadway, New York, on June 1, 1916.

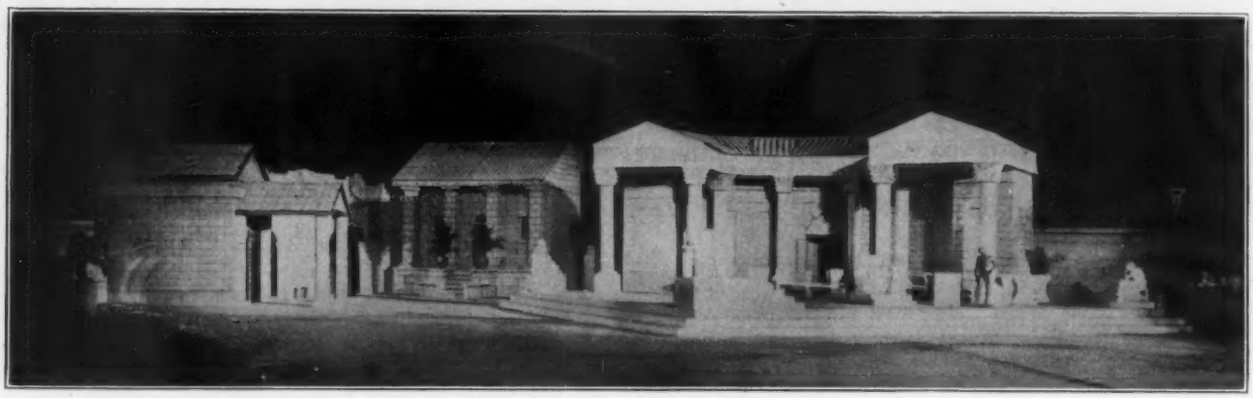
The Ward Leonard Electric Company, manufacturers of electric controlling devices, has moved into its new building at Mount Vernon, N. Y. The increased demand for floor space and labor operators is the reason for changing. The Ward Leonard Electric Company started manufacturing electric controlling devices in Bridgeport, Conn., in 1892. After two years in Bridgeport, and three years in Hoboken, N. J., they moved to Bronxville, N. Y., and have been manufacturing in Bronxville since 1897, or for the past 19 years. Mount Vernon is nearer New York than Bronxville—as a matter of fact, the new Ward Leonard Factory is 150 feet from the New York City limits.

FLOOD LIGHTING OF "JULIUS CAESAR."

BY E. L. NIGHTINGALE.

An audience of 40,000 people was given a glimpse of Old Rome, its populace, forum, arena, Capitol Hill, ravines, canyons and battlefields, on the evening of May 19, 1916, when 5000 actors presented Shakespeare's "Julius Caesar" in a 400 acre area unhampered by a stage or its confines, as it has never been presented before.

The buildings and clearings faithfully portrayed the Rome described by Shakespeare, but it was the General Electric flood lighting projectors that made the great spectacle possible at night. Flood lighting projectors were concealed in a unique and ingenious manner on the hill-sides to the right and left of the audience—in such a manner that the source of light was invisible. The light rays coming from two directions on the stage formed a V, which gave the appearance of daylight on the buildings, stages and actors, but did not compel the actors to face a spot-light at any time.



Flood Lighting of "Julius Caesar."

Daylight effects at night were obtained by the addition of any coloring scheme required to portray the time of day, enhance the lurid glare of tragedy or the green light of intrigue, etc., by using color screens. No drop curtains were available, the stage being darkened by contrast, by throwing the flooded light on the audience—which concealed the changes being made.

Flashes of light on the six stages at various times were also made as a cue to the actors; this was very effective during mob scenes as instantaneous activity and enthusiasm were obtained. The true colors of the costumes were brought out vividly by the flood light. Five acres of ground were covered in a spectacular manner with six million candle power, the light being projected a distance of from 100 to 1000 ft. with excellent results.

In the last act a tremendous climax was reached when the armies of Cassius and Anthony met on the Philippian Plains. Their figures were sharply silhouetted by the light being placed back of the battlefield. The effect was weird and picturesque in the extreme.

The success of the production was due to the cooperation of all the prominent artists in the theatrical world, backed by the Hollywood Carnival Association and supported by other civic interests. The Pacific Light & Power Corporation at much expense provided an extension to their service and their representative, R. E. Smith, illuminating engineer, worked out the details and lighting effects in a practical and creditable manner.

HOSPITAL FINDS NOVEL USE FOR ELECTRIC AIR HEATER.

The St. Marks Hospital of Salt Lake City, Utah, has a set of four dumb waiters running from the basement to the first, second and third floors carrying food from the kitchen to the various wards. Great difficulty was encountered in keeping the food warm from the time it left the kitchen until it arrived at its destination.

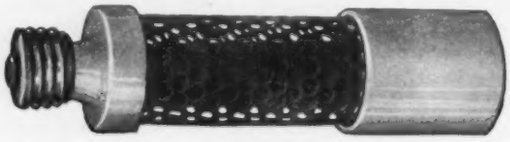
Mr. Chadron, general manager of the hospital, gave the problem careful study and finally designed and had built seven portable wagons. These wagons accommodate 26 trays and are arranged with sliding doors that make them practically air tight. A Western Electric navy type air heater is mounted on the bottom of the wagon with a cord and plug attachment capable of being connected ten feet away from the wagon. An hour before each meal the various heaters are connected to a source of electric current so that at meal time the interiors of the wagon are satisfactorily heated. After the wagons are loaded with the trays of food, the heaters are disconnected and the whole contrivance is placed on the elevator and raised to its destination where the heater is again connected to a source of current supply and remains so until the last tray is removed.

The new system is in constant operation and it is found to work perfectly—the food is served to the patients quite as warm and palatable as when it left the kitchen range. The installation has been the object of favorable comment in hospital circles.

THE ADAPTOR RESISTANCE.

The "Adaptor" resistance is a new form of convenience resistance unit made by the Ward Leonard Electric Company of Mount Vernon, New York.

This resistance consists of a Ward Leonard enameled resistance unit with an Edison base screw plug at one end and an Edison socket at the other end. This unit provides a convenient means of interposing resistance in a circuit. It can be furnished in practically any capacity and size required. It is used quite extensively to enable the universal



The Adaptor Resistance.

type motors to be used on either a.c. or d.c. on any constant given speed. It is also used in connection with low voltage apparatus when run on high voltages.

The resistance unit consists of a porcelain tube having a low temperature co-efficient wire wound upon it, the joint between the resistance wire and the terminal lead is made while the parts are bright and clean, under high pressure. The entire resistance winding, as well as this joint, is embedded in a coating of vitreous enamel, which thoroughly protects it from electrical, chemical and mechanical disintegration.

NEWS NOTES

INCORPORATIONS.

GRANGEVILLE, IDAHO.—Articles of incorporation have been filed of the Winona-Cottonwood Telephone Company Limited, the capital being $1500. The place of business is Green Creek. The directors are Adolph Hinkleman, S. W. Hamill, Joseph E. Eller and J. J. Trautman of Green Creek and C. L. Morris of Winona.

ILLUMINATION.

LOS ANGELES, CAL.—The board of supervisors has made an order authorizing the furnishing of lamps for the present needs of the Bell Lighting District.

PASADENA, CAL.—The only bid received for the Green street lighting system was submitted by the Keystone Iron Works and the contract was awarded to that firm for $1078.

LOS ANGELES, CAL.—Instructions have been issued to the board of public works by the council to advertise for bids for contract to light the streets for six months, beginning July 1.

CHLORIDE, ARIZ.—Robert Roe has been granted a franchise for the construction and operation of a plant for the generation of electricity for lighting, heating and power purposes in the town of Chloride.

LOS BANOS, CAL.—B. S. Pedersen was here recently to consult W. H. Worswick, Jr., and others regarding the installation of a gas plant. It is estimated a plant of sufficient size to meet the demands of Los Banos can be erected, fully equipped for $20,000.

SANTA BARBARA, CAL.—Concrete ornamental lighting posts may be erected along Carrillo street from State to Castillo. Property owners express belief that arrangements might be made for immediate installation, and even for extending the system almost the entire length of the street.

TULARE, CAL.—The Tulare County Users' Association has been organized to protect and advance the interests of its members using electricity. Headquarters for the association are in Tulare, and the following officers have been elected: G. W. Jones, president; A. C. Rosenthal, secretary; C. W. Zartman, treasurer.

PHOENIX, ARIZ.—The city commission has decided to request the Department of the Interior to hold up the matter of approving the new power contract with the Pacific Gas & Electric Company until the people of Phoenix can vote on the bonds for a municipal electric light and gas plant. It has been proposed that an election be ordered to vote on bonds for this purpose in the sum of $600,000.

TRANSMISSION.

OROVILLE, CAL.—J. M. Howell, chief engineer of the Great Western Power Company, states that surveys for the purpose of locating a site for a new power plant on the Feather River between Intake and Belden are being made.

SAN FRANCISCO, CAL.—City Engineer O'Shaughnessy has returned from Hetch-Hetchy Valley, after picking a location for a temporary power plant, which is to be built at an estimated cost of $100,000 for supplying current for the construction of the dam. This power plant will be 12 miles from the big dam.

OCEANSIDE, CAL.—H. H. Jones, manager of the San Diego Electric Company, and H. M. Byllesby of the Byllesby Company, were here recently in connection with the proposed purchase of the local electric plant. A favorable decision is expected in a few days. It is stated that extension of the line from San Diego to Oceanside by August 1st is a strong probability.

NORTH YAKIMA, WASH.—The U. S. Reclamation Service, Denver, Colo., is taking bids until 2 p. m. June 5th for furnishing and erecting equipment for the Grandview irrigation project near North Yakima, Wash. The bids cover: Generator, transformers, switchboard equipment, hydraulic turbine, steel pipes, pumps, head gates, etc. Particulars from U. S. Reclamation Service at North Yakima, Wash.

TELEPHONE AND TELEGRAPH.

OROVILLE, WASH.—Mrs. Luella R. Anderson has sold the local telephone line to the Pacific Telephone & Telegraph Company.

KELLOGG, IDAHO.—The Interstate Utilities Company is planning to rebuild its entire distributing plant in Wardner and Kellogg.

VALLEJO, CAL.—The Pacific Telephone & Telegraph Company has applied for a franchise in this city. Sealed bids will be received for said franchise up to June 20th.

NORTH YAKIMA, WASH.—The Yakima Valley Telephone Company has filed with the county commissioners an application for a right of way for 50 years over county roads, for extensions of its lines south of Mabton.

SAN BERNARDINO, CAL.—The Union Home Telephone & Telegraph Company has offered its telephone plant to the city of San Bernardino for the sum of $10, providing the city will vote to issue bonds amounting to at least $400,000.

CHULA VISTA, CAL.—Work on the installation of a new Bell telephone exchange in Chula Vista, involving an expenditure of about $25,000, will begin at once, it has been announced. Some of the field work is already under way. The new exchange will open with about 400 subscribers.

SANTA BARBARA, CAL.—Extensive rebuilding of all its lines over the county is planned for this summer by the Pacific Telephone & Telegraph Company, according to General Foreman Tucker, who has charge of construction work. It is stated that all lines between here and Monterey will be rebuilt, present poles being replaced with larger ones.

PLACERVILLE, CAL.—Local forest officials are planning the immediate construction of a telephone line in Georgetown district of the El Dorado National Forest, 9 miles in length, extending from Onion valley to Hartless ranger station. Another line approximately 5 miles in length is to be constructed to connect this line directly with Bald Mountain lookout station. J. M. Hughes and M. D. Morris will have charge of the work.

FRESNO, CAL.—Authorization for the expenditure of approximately $36,000 to enlarge the service to take care of the new districts, to place wires underground and to make general improvements in towns near Fresno has been made by the general office of the Pacific Telephone & Telegraph Company, and it is thought the work will be finished within the next eight months. Long distance loops will be installed from Dos Palos to Mendota, Fresno to Jamison and from Fresno to Kerman. This work will cost $4390, and will be completed within five months.

TRANSPORTATION.

PORTERVILLE, CAL.—Work has started on a survey of a system of interurban electric lines, subsidiary to the S. P. Railroad, to be built through the mining section and into orchard areas where new groves are coming into bearing. Engineers who took the field are J. Roy Clark, L. H. Conway, W. T. Davey, and K. F. Biehler, all of whom were formerly with the engineering department of the Pacific Electric Railroads.

ALPHABETICAL INDEX TO ADVERTISERS

The letter and number before each name are used in the classified page following

A-1 American Ever-Ready Works of National Carbon Co..
Los Angeles; 755 Folsom St., San Francisco; Seattle.

A-2 Atchison, Topeka & Santa Fe Railway Co.....
673 Market St., San Francisco; 1218 Broadway, Oakland.

B-1 Baker-Joslyn Company.....
71 New Montgomery St., San Francisco; 911 Western Ave., Seattle; 353 E. Second St., Los Angeles.

B-2 Benjamin Electric Manufacturing Co.....
590 Howard St., San Francisco.

B-5 Bridgeport Brass Co..... 5
(See Pierson, Roeding & Co.)

C-1 Century Electric Co..... 4
906 So. Hope St., Los Angeles; 56 Natoma St., San Francisco; 65 Front St., Portland, Ore.

C-3 Crocker-Wheeler Co.....
Crossley Bldg., 618 Mission St., San Francisco; 228 Central Avenue, Los Angeles.

C-4 Cutler-Hammer Manufacturing Co.....
579 Howard St., San Francisco; Morgan Bldg., Portland, Ore.; San Fernando Bldg., Los Angeles.

D-4 Davis Slate & Manufacturing Co..... 3
Chicago, Ill.

D-2 Dearborn Drug and Chemical Works..... 3
355 East Second St., Los Angeles; 301 Front St., San Francisco.

E-7 Economy Fuse & Mfg. Co.....
Kinzie and Orleans Sts., Chicago.

E-1 Edison Lamp Works of General Electric Co.....
Rialto Bldg., San Francisco; 724 So. Spring St., Los Angeles.

E-2 Edison Storage Battery Supply Co..... 11
441 Golden Gate Ave., San Francisco.

E-3 Electric Agencies Co.....
247 Minna Street, San Francisco; Central Building, Los Angeles.

E-6 Electric Novelty Works.....
533 Mission St., San Francisco.

E-4 Electric Storage Battery Co..... 3
743 Rialto Bldg., San Francisco.

E-5 Electric, Railway & Manufacturing Supply Co..... 11
34 Second St., San Francisco.

F-1 Fairbanks, Morse & Co.....
Los Angeles; Portland; 651 Mission St., San Francisco; Seattle; Spokane.

F-3 Federal Sign System (Electric).....
618 Mission St., San Francisco.

G-1 General Electric Co..... 10
724 So. Spring St., Los Angeles; Worcester Bldg., Portland; Rialto Bldg., San Francisco; Colman Bldg., Seattle; Paulsen Bldg., Spokane.

G-1 General Vehicle Co.....
1117 Van Ness Ave., San Francisco; 331 Wall St., Los Angeles; British Columbia Electric Ry., Ltd., Vancouver, B. C.

H-1 Habirshaw Wire Co.....
(See Western Electric Company.)

H-2 Hemingray Glass Co..... 3
236-240 So. Los Angeles St., Los Angeles; 345 Oak St., Portland; 807 Mission St., San Francisco.

H-3 Haller-Cunningham Electric Co..... 5
428 Market St., San Francisco.

H-5 Hunt, Mirk & Co.....
141 Second St., San Francisco.

H-7 Hurley Machine Co.....
New York and Chicago. (See Pacific States Electric Co.

I-2 Illinois Electric Co.....
261-263 So. Los Angeles St., Los Angeles.

I-3 Interstate Electric Novelty Co.....
111 New Montgomery St., San Francisco.

L-1 Leahy Manufacturing Co.....
Eighth and Alameda St., Los Angeles.

L-2 Locke Insulator Manufacturing Co..... 5
(See Pierson, Roeding & Co.)

M-2 McGlauflin Manufacturing Co.....
Sunnyvale, Cal.

M-4 Morse Chain Company..... 6
Monadnock Bldg., San Francisco.

M-3 Moore & Co., Charles C..... 3
Van Nuys Bldg., Los Angeles; Spalding Bldg., Portland, Kearns Bldg., Salt Lake City; Sheldon Bldg., San Francisco; Mutual Life Bldg., Seattle; Santa Rita Hotel Bldg., Tucson.

N-1 Nason & Co., R. N.....
151 Potrero Ave., San Francisco.

N-6 National Carbon Company..... 12
Cleveland, Ohio.

N-2 National Conduit & Cable Co., The.....
Trust and Savings Bldg., Los Angeles; Rialto Bldg., San Francisco.

N-3 National Lamp Works of G. E. Co..... 4
(All Jobbers.)

N-4 New York Insulated Wire Co..... 2
629 Howard St., San Francisco.

N-5 Northwestern Pacific Railroad..... 3
808 Phelan Bldg., San Francisco.

O-1 Okonite Co. (The)..... 12
(All Jobbers.)

P-1 Pacific Electric Manufacturing Co.....
80 Tehama St., San Francisco.

P-2 Pacific States Electric Co..... 2
236-240 So. Los Angeles St., Los Angeles; 61-67 Fifth St. No., Portland; 200-210 Twelfth St., Oakland; 575 Mission St., San Francisco; 307 First Ave. So., Seattle.

P-4 Pelton Water Wheel Co..... 11
2219 Harrison St., San Francisco.

P-5 Pierson, Roeding & Co..... 5
Pacific Electric Bldg., Los Angeles; Rialto Bldg., San Francisco; Colman Bldg., Seattle.

P-6 Pittsburgh Electric Specialties Company.....
202 Aronson Bldg., San Francisco.

P-7 Pittsburgh Piping & Equipment Co..... 12
Monadnock Bldg., San Francisco.

S-1 Schaw-Batcher Company, Pipe Works, The.....
211 J St., Sacramento; 356 Market St., San Francisco.

S-4 Southern Pacific Co..... 4
Flood Bldg., San Francisco.

S-5 Sprague Electric Works..... 3
Rialto Bldg., San Francisco; Colman Bldg., Seattle; Corporation Bldg., Los Angeles; Electric Bldg., Portland; Paulsen Bldg., Spokane.

S-6 Standard Underground Cable Co..... 3
First National Bank Bldg., San Francisco; Hibernian Bldg., Los Angeles; Yeon Bldg., Portland; Central Bldg., Seattle, Wash.

T-1 Thomas & Co., R.....
Pacific States Electric Co. and Western Electric Co., Pacific Coast Representatives.

T-2 Tubular Woven Fabric Company.....
Pawtucket, R I.

U-1 Union Sheet Metal Works.....
575 Howard St., San Francisco.

W-1 Wagner Electric Manufacturing Company.....
St. Louis, Mo.

W-2 Western Electric Co..... 12
Eighth and Santee Sts., Los Angeles; 1901 Telegraph Ave., Oakland, Cal.; 680 Folsom St., San Francisco; 907 First Ave., Seattle; 45 North Fifth St., Portland, Ore.

W-3 Ward-Leonard Electric Co..... 2
Mt. Vernon, New York.

W-4 Westinghouse Electric and Manufacturing Co.....
50-52 East Broadway, Butte; Van Nuys Bldg., Los Angeles; Couch Bldg., Portland; 212 So. W. Temple, Salt Lake City; 165 Second St., San Francisco; Second and Cherry Sts., Seattle; Paulsen Bldg., Spokane.

W-5 Westinghouse Machine Co.....
141 Second St., San Francisco.

W-6 Westinghouse Lamp Co.....
(See Westinghouse Electric & Manufacturing Co.)

W-8 Western Pipe & Steel Co.....
444 Market St., San Francisco; 1758 North Broadway, Los Angeles.